Reconstruction of the Internal Nasal Valve with a Splay Conchal Graft

Mehdi Deylamipour, M.D., Aram Azarhoshangh, M.D., and Hamid Karimi, M.D.

Tehran, Iran

Summary: The internal nasal valve is the narrowest point in the nasal airway and thus is the controlling point that regulates inspiration flow. The cross-sectional area of the internal nasal valve is approximately 40 to 55 mm, and 40 to 50 percent of inspiratory resistance is attributable to internal nasal valve function. Collapse of one or both internal nasal valves can be a consequence of previous surgery, trauma, aging, or primary weakness of the upper lateral cartilage. In this study, autologous conchal cartilage was used as a splay graft for opening and reconstructing the internal nasal valve. Over 3.5 years, 31 patients (18 female patients and 13 male patients) were operated on using the splay graft. Inclusion criteria were positive Cottle sign and modified Cottle sign. Cause of collapse was previous surgery in 12 patients (38.7 percent), primary weakness in 10 patients (32.3 percent), and nasal trauma in nine patients (29 percent). After 10 to 42 months of follow-up, 80.6 percent of patients had good to excellent (stable) subjective respiratory function. There was no major morbidity or complication after surgery. Six patients complained of broadening in the middle nasal vault. (*Plast. Reconstr. Surg.* 116: 712, 2005.)

Nasal obstruction is one of major complications of aesthetic rhinoplasty. Surgeons who have practiced rhinoplasty or septorhinoplasty are familiar with this complication. Several methods for correction of obstruction at the internal nasal valve level have been proposed and published, each with its own advantages and disadvantages. Procedures used include suturing the upper lateral cartilages together over the dorsal septum (upper lateral cartilage suspension),[1] maintaining convexity of cartilages with mattress sutures,[2] inserting (resected) convex septal cartilage, bending the upper lateral cartilage,[3] using a spreader[4–6] suspension of the upper lateral cartilage to the nasal bone,[7] and using splay or butterfly conchal graft.[6,8,9] Previous nasal surgery is by far the most common cause.[10,11] Occasionally, patients may have nasal collapse from very frail lateral nasal walls because of aging (age >50 years) or primary intrinsic weakness of the upper lateral cartilage. Sometimes, nasal trauma may cause scarring and weakening of cartilage.

In this study, we performed conchal splay grafting for those patients who had constriction of the internal nasal valve either primarily or secondary to previous surgery. Nasal obstruction was graded using a simple method based on preoperative and postoperative signs and symptoms observed over 3.5 years of follow-up. This article not only emphasizes the result of splay graft but also provides indications for performing this corrective procedure.

Patients and Methods

Over 3.5 years, all of the patients who had presented to the private office of the senior author (Deylamipour) for rhinoplasty or septorhinoplasty were examined. Patients completed a questionnaire, and data such as history

From Hazrat Fatemeh Hospital, Iran University of Medical Sciences. Received for publication September 23, 2002; revised June 2, 2003. Presented at the Rhinoplasty and Ancillary Surgery meeting, in Tehran, Iran, February 25 to 27, 2002.

DOI: 10.1097/01.PRS.0000117182.95245.D9

TABLE I
Grading of Nasal Obstruction

Grade	Description
1	Excellent airway: normal airway during regular and deep respiration during the day and night and during exercise
2	Good airway: normal airway during regular respiration and during the day and night, but not during exercise
3	Moderate airway: normal airway during regular respiration and during the day, but not during exercise and during the night
4	Fair airway: normal airway during regular respiration but not during exercise and during the day and night
5	Poor airway: bad and difficult respiration even during regular airway inspiration

FIG. 1. A 21-year-old woman with a narrow nose and primary weakness of the upper lateral cartilage. (*Above, left*) Step incision for open rhinoplasty. (*Above, right*) Dissection of alar cartilages. (*Center* and *below*) Insertion of trimmed conchal graft.

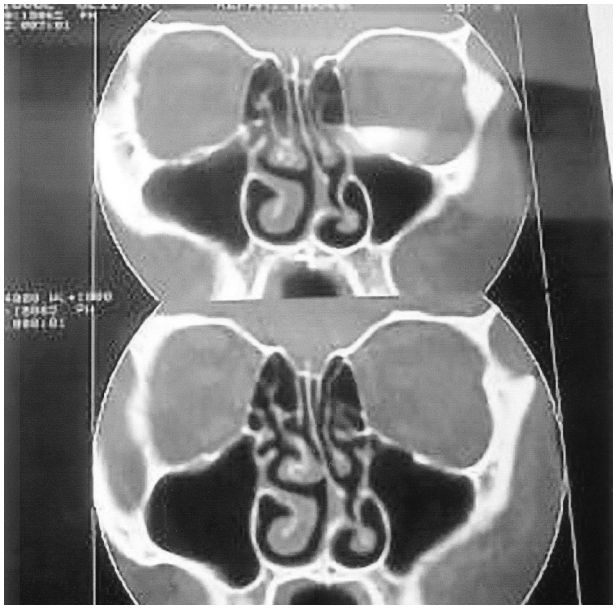

FIG. 2. Computed tomographic scan of a severely deviated septum. Note hypertrophy of the right inferior turbinate.

of previous trauma or surgery and any similar family history (for primary cases) were recorded. Patient demographic data and side of the obstruction were noted. Simple grading of obstruction was obtained and recorded, according to Table I. All of the patients who had a positive Cottle sign[12] (i.e., decreased subjective sense of obstruction after manual lateral and upward traction of cheek and alar skin) and positive modified Cottle sign (i.e., decreased subjective sense of obstruction after insertion of a cotton swab or nasal speculum into the internal nasal valve and manual opening of internal nasal angle) were included in study. Patients with allergic rhinitis were excluded.

TABLE II
Grading of Nasal Obstruction before and after Surgery*

	Grade					
	Poor	Fair	Moderate	Good	Excellent	Total
Before surgery	15	11	4	1	0	31
After surgery	1	0	5	2	23	31

* $p < 0.02$.

During the 10- to 42-month follow-up period, patients were visited weekly for 2 weeks, biweekly for 2 months, and then monthly thereafter. Questionnaires were completed, patients were asked about improvement in nasal obstruction, and the nasal obstruction was graded following the classification in Table I.

Operative Technique

The open technique was used for rhinoplasty (Fig. 1, *above*), and conchal cartilage was harvested through a postauricular incision and with the posterior perichondrium attached. We removed the entire concha to obtain the greatest length possible to ensure adequate lateral extension. The graft was shaved and trimmed to a uniform thickness. In this way, we can easily bend the concha, shape it, and place it under the upper lateral cartilages (Fig. 1, *center*, *left*). The upper lateral cartilages were freed from the underlying mucosa (Figs. 1, *center*, *right* and 2) and the concha was placed between them bilaterally in such a way that perichondrium was placed over the septum, in contrast to the original operation (Fig. 1, *center*, *right* and *below*).[9] In this way, the lateral aspect of the cartilage is placed upward and below the upper lateral cartilage and skin, and the me-

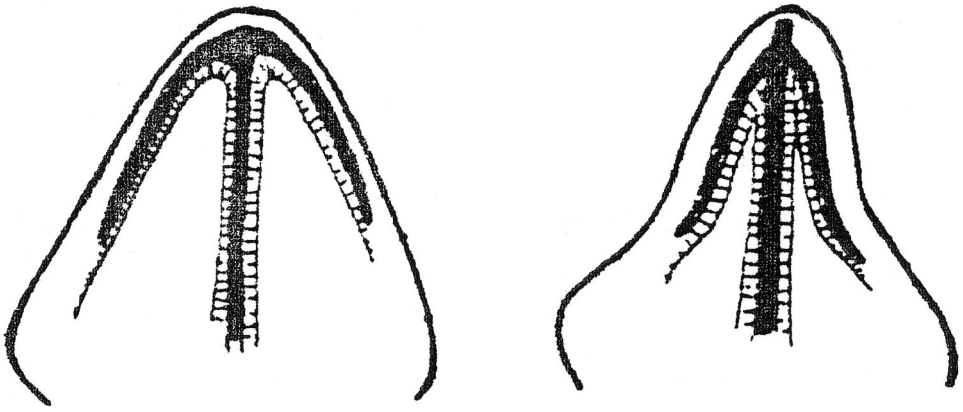

FIG. 3. (*Left*) Diagram demonstrating a normal internal nasal valve with a well-positioned upper lateral cartilage and a normal angle. (*Right*) A nearly closed angle with weakness of the upper lateral cartilage and protrusion of the lateral wall into the internal nasal valve space.

FIG. 4. (*Left*) Preoperative views. (*Below*) Profile view after surgery. (*Right*) Postoperative views 3.5 years after surgery.

dial aspect of the concha with its perichondrium faces the dorsal septum.

This method produces a T-shaped configuration of the upper lateral cartilages and septum, and we can use most of its elastic force for opening of the internal nasal valve (Fig. 3). In the previous method, the concha was placed like an upside-down U between the upper lateral cartilages, and especially in the most lateral sides, it cannot produce enough force for

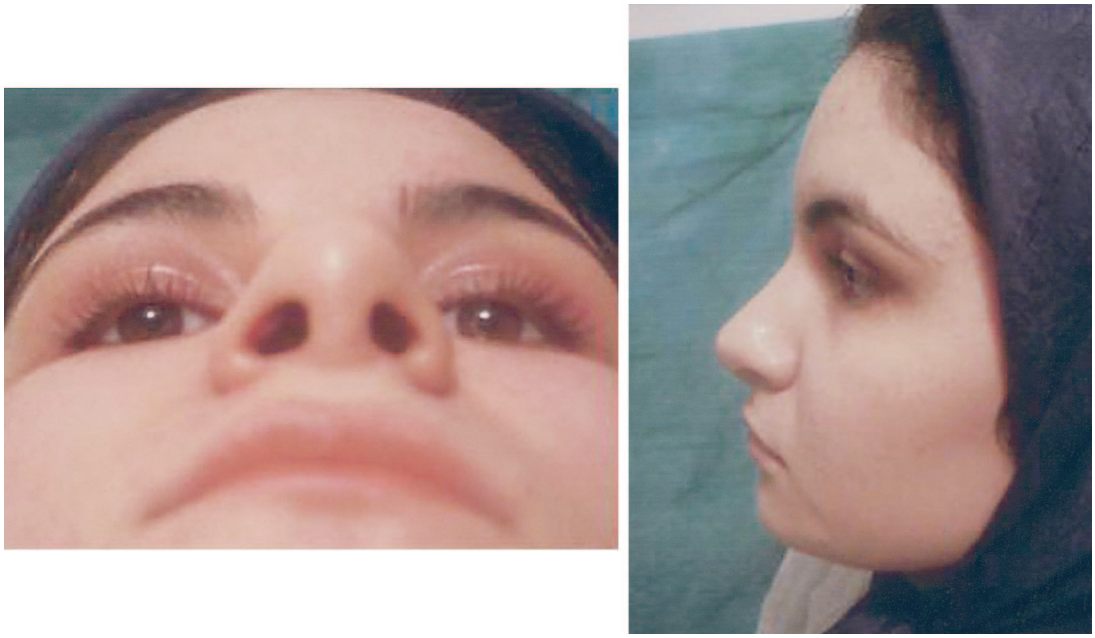

FIG. 5. Photographs obtained at follow-up 3.5 years postoperatively.

opening of the internal nasal valve. In the technique using the U-shaped configuration, the lateral part of the concha may protrude into the nasal mucosa. Also, placing the concha in the T configuration elevates the lateral side more effectively. Placing the concha in this way will produce and maintain more force for splaying (opening) of the upper lateral cartilages. After removal of the hump, there is enough space to place the concha, and it will never be seen from outside.

There is no need to feather the lateral margins, because they are placed below the upper lateral cartilages (Fig. 1, *center*, *right*) and the concha is fixed in its place with one or two 4-0 nylon mattress sutures. Thus, we can use the maximal recoil potential of the cartilage, which is needed to splay or separate the upper lateral cartilages and will produce a good internal nasal valve for normal nasal breathing. The intrinsic recoil and strength of the concha supports the lateral wall. No suture is placed in the mucosa, and the skin is closed as for the standard external method. A splint was applied over the nose and removed as usual in 7 to 10 days. A lubricated packing was placed for just 12 to 24 hours. The external approach greatly facilitates dissection and reconstruction of the valve and endonasal lining. It does not require additional incisions, such as a mucosal incision, that can further compromise the valve region. With the open technique, graft placement and fixation are optimized and operation time is minimized. In this method, the nasal lining should be dissected from the underside of the upper lateral cartilage (Fig. 1, *center*, *right*). This is a very time-consuming and technically demanding part of the operation, particularly because of the scars that are developed after previous surgery. Nasal lining dissection can more readily be performed with the open approach (Fig. 1, *above*).

RESULTS

Of the 270 patients who underwent rhinoplasty or septorhinoplasty over a 3.5-year period, 27 had positive and modified Cottle signs and did not exhibit signs of allergic rhinitis preoperatively. All of these patients were included in the study. Also, during primary rhinoplasty for four other patients, it was noted that the internal nasal valve was weak and would collapse readily, so a splay graft was inserted during the primary operation.

Of these 31 patients, 18 were women and 13 were men. The mean age was 29.6 years (range, 18 to 53 years).

Six patients were heavy smokers (>60 pack-years). None had a history of asthma. None revealed history of allergic reaction, but one of the patients described a history of allergic rhinitis postoperatively. Cause of collapse was previous rhinoplasty in 12 patients (38.7 percent), primary weakness with no history of nasal trauma or surgery in 10 patients (32.3 percent), and trauma in nine patients (29 percent). Five patients had

FIG. 6. (*Above, left*) Preoperative photograph of a 35-year-old man with a history of previous rhinoplasty. (*Above, right, center*, and *below*) Postoperative views obtained 26 months after surgery.

unilateral and 26 patients had bilateral nasal obstruction. In the unilateral group, two patients had a history of a previous operation and three were in the right and two were in the left side of the nose. The operative technique for the unilateral cases was the same as for the bilateral cases.

Other symptoms or complaints patients had included dryness of mouth in seven patients,

FIG. 7. (*Left*) Photograph demonstrating step incision. (*Right*) Photograph demonstrating dissection of the upper lateral cartilages.

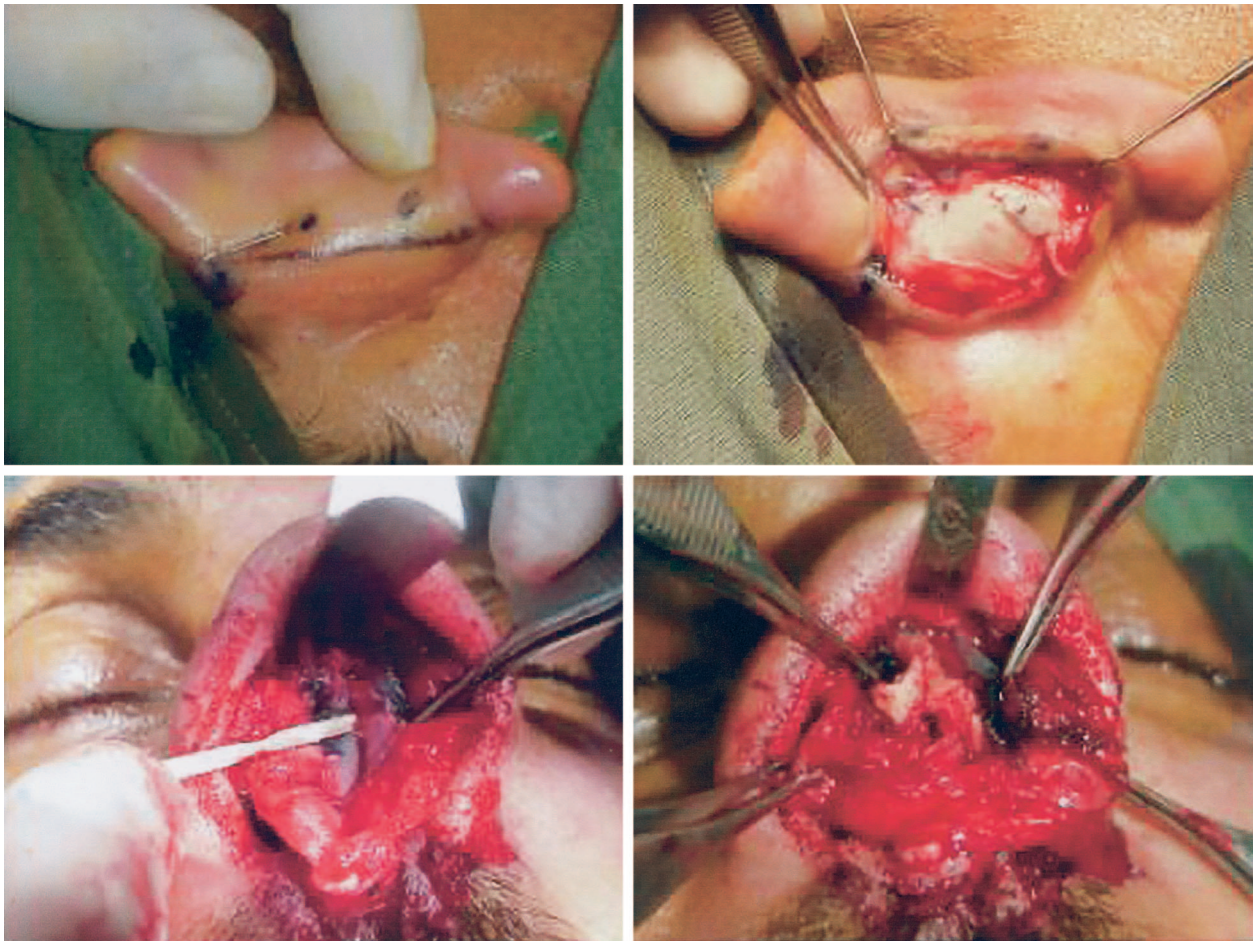

FIG. 8. (*Above, left*) Photograph demonstrating postauricular incision. (*Above, right*) Photograph demonstrating total dissection of concha. (*Below, left*) Dissected upper lateral cartilages are marked with methylene blue. (*Below, right*) Photograph demonstrating insertion of conchal graft.

sinusitis in two patients, headache in two patients, and nocturnal dyspnea or respiratory obstruction in 14 patients. Table II shows the results of the grading of nasal obstruction before and after surgery. Twenty-five (80.6 percent) patients had good to excellent results and five (16.1 percent) had moderate results.

All of the conchal cartilage grafts were harvested from the right ear; the graft was harvested bilaterally in only one patient. In 12 patients, septoplasty was also performed, and in 12 patients, bilateral spreader grafts were applied because of weakness of the septal dorsum after the operation. During the course of 10 to 42 months of follow-up, no complication or morbidity was noted at the graft donor site and no major complication such as bleeding, infection, or extrusion of graft was reported at the recipient site (nose). Six patients complained about broadening of the middle nasal vault, but all of them accepted this without difficulty, considering the functional benefits of the surgery. All of them were secondary rhinoplasty cases, and they preferred the result achieved to hardly being able to breath through the obstructed nose.

CASE REPORTS

Case 1

A 21-year-old woman presented for rhinoplasty. At examination, weakness of the upper lateral cartilages, severe deviation of the septum, and hypertrophy in the right lower turbinate were noted. She was operated on with the open technique. A splay conchal graft was placed between the upper lateral cartilages (Figs. 1, 2, 4, and 5).

Case 2

A 35-year-old man with a history of previous rhinoplasty noted that, after surgery, he could hardly breath through his nose. After 4 years, he came to our office. On examination, both internal nasal valves were constricted. Open rhinoplasty with splay graft was performed. At follow-up, he stated that he finally could breath normally after 4 years and that he was very glad. (Figs. 6 through 8).

DISCUSSION

Internal nasal valve collapse is a serious complication after rhinoplasty. Most of the time, the patient is someone who seeks an aesthetically pleasing nose and face but after surgery notices that he or she can hardly breathe through that "improved" nose. When the problem is bilateral, these patients are essentially 100 percent mouth breathers. A surgeon has many difficulties in dealing with this problem.

Although a majority of nasal value collapse is attributable to previous rhinoplasty, sometimes it is caused by trauma or aging. Also, the upper lateral cartilage occasionally has a primary weakness. Iatrogenic valvular dysfunction after aggressive resection of the middle nasal vault during primary rhinoplasty will invariably result in this complication. These patients apparently will have a constricted nasal valve after surgery, and if the surgeon uses prudent judgment and directs sufficient attention during primary surgery, he or she will decide that these patients may benefit from a conchal graft during the initial operation. A common feature for the iatrogenic category was the removal of the middle nasal vault including a portion of the upper lateral cartilage, mucosa, and septum. Violation of the middle vault T would result in posterior migration of the upper lateral cartilages and attachment to the septum. A weak scar hinge will develop into a sharper angle than the usual 10 to 15 degrees (Fig. 3, *right*). The flaccidity of the upper lateral cartilage decreases the width of the nasal vault.

This narrowing has the effect of increasing the relative vacuum and sucks the flaccid lateral nasal wall medially until it is in contact with the septum, resulting in total nasal obstruction. This structural weakness is accentuated by inward bowing of the central portion of the lateral wall and is caused by loss of cartilage support.

The main objective in reconstruction of the internal nasal valve is to provide support and stiffness to open up the internal nasal valve angle and to reestablish a stiff or resistant nasal side wall that does not bow inward. With this technique, we have attempted to provide recoil and strength to the internal nasal valve by grafting the conchal cartilages to the angle. Some have advocated using septal cartilage (especially curved septum), but it does not have enough recoil and strength for this purpose, and it is very short and we do not recommend its use.

In the original technique, it was placed with its curve downward, but we think it has less recoil power and will have a U shape, which is not sufficient for lateral-side widening of the upper lateral cartilages. Also, the U may have constricting effects after a few months or a year. In this study, we placed the anterior side or concave side of the concha upward. In this way, we used the greater intrinsic strength of the cartilage to open the internal nasal valve angle, and the lateralmost part could be opened very easily and effectively.

The graft was shaved, trimmed, and shaped to the size of the internal nasal valve. The margins of the graft were placed below the upper lateral cartilages so they would not need feathering and

so patients would never see or feel its margins. Six patients complained of broadening of the middle nasal vault. Most of these patients (four of six) had a narrow nose before surgery, so it may be reasonable that in the case of a narrow nose, cartilage should be shaved and trimmed even further, although this thinning may decrease the elastic quality of the graft. During the 10- to 42-month follow-up period, nearly all of the patients had experienced much better breathing and stable relief of nasal obstruction (Table II and Figs. 4 and 6). All of the patients were satisfied with the result of their surgery; only one patient (3.2 percent) was not satisfied, and this patient had a very compressed airway after surgery. At follow-up, it appeared that he had a history of allergic rhinitis, and he was treated medically and has a better airway. Result of relief of obstruction was stable and did not deteriorate with time. Other authors found that cartilage will not undergo absorption or atrophy. No complication or morbidity was noticed at the donor site.

Conclusions

According to our results, allergic rhinitis is a relative contraindication for splay grafting. We placed the concha with its concave side facing upward, and we recommend this modification to achieve a much better result.

Hamid Karimi, M.D.
Faculty of Medicine
Iran University of Medical Sciences
P.O. Box 19395-4949
Tehran, Iran
h.karimi@iums.ac.ir

Acknowledgments

The authors thank M. Gevert, A. Lahroodi, F. Hamsayeh, and K. Goodarzi.

References

1. Sciuto, S., and Bernardeschi, D. Upper lateral cartilage suspension over dorsal grafts: A treatment for internal valve dynamic incompetence. *Facial Plast. Surg.* 15: 309, 1999.
2. Meyer, R., Jovanovic, B., and Derder, S. All about nasal valve collapse. *Aesthetic Plast. Surg.* 20: 141, 1996.
3. Seyhan, A. Method for middle vault reconstruction in primary rhinoplasty: Upper lateral cartilage bending. *Plast. Reconstr. Surg.* 100: 1941, 1997.
4. Prendiville, S., Zimbler, M. S., Kokoska, M. S., et al. Middle-vault narrowing in the wide nasal dorsum: The "reverse spreader" technique. *Arch. Facial Plast. Surg.* 4: 52, 2002.
5. Sheen, J. H. Spreader graft: A method of reconstructing the roof of middle nasal vault following rhinoplasty. *Plast. Reconstr. Surg.* 73: 230, 1984.
6. Ozturan, O. Techniques for the improvement of the internal nasal valve in functional-cosmetic nasal surgery. *Acta Otolaryngol.* 120: 312, 2000.
7. Parkes, M. L., and Kanodia, R. Avulsion of the upper lateral cartilage: Etiology, diagnosis, surgical anatomy and management. *Laryngoscope* 91: 758, 1981.
8. Stucker, F. J., and Hoasjoe, D. K. Nasal reconstruction with conchal cartilage. *Arch. Otolaryngol. Head Neck Surg.* 120: 653, 1994.
9. Guyuron, B., Michelow, B. J., and Englebardt, C. Upper lateral splay graft. *Plast. Reconstr. Surg.* 102: 2169, 1998.
10. Goode, S. L. Surgery of the incompetent nasal valve. *Laryngoscope* 95: 546, 1985.
11. Conley, J. Intranasal composite grafts for dorsal support. *Arch. Otolaryngol.* 111: 241, 1985.
12. Heinberg, C. E., and Kern, E. B. The Cottle sign: An aid in physical diagnosis of nasal airflow disturbances. *Rhinology* 11: 89, 1978.